



Data Article

Local climate zones datasets from five Southern European cities: Copernicus based classification maps of Athens, Barcelona, Lisbon, Marseille and Naples

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ABSTRACT

Here, we provide Local Climate Zones (LCZ) map datasets from five Southern European Mediterranean cities: Athens (Greece), Barcelona (Spain), Lisbon (Portugal), Marseille (France) and Naples (Italy). The maps were produced according to a geographic information system (GIS)-based classification method, using freely available Copernicus Land Monitoring Service (CLMS) input data. Several maps are provided: (i) five *LCZv1* maps (one per city) depicting urban LCZ's aggregated by density (no building height information); (ii) five *LCZv1_leaf* maps (one per city), identical to the previously mentioned ones, with tree cover LCZ classes A and B reclassification according to the Dominant Leaf Type (DLT) (deciduous or coniferous); (iii) two *LCZv1_BH* maps (Athens and Lisbon) distinguishing urban LCZ classes 123 and 456 according to the dominant building height (BH); and (iv) two *LCZv1_leaf_BH* maps (Athens and Lisbon) identical to the previous ones with added DLT-based land cover classification. The LCZ classification maps are available in both *ArcGIS .lyr* layer and *GeoTIFF raster* formats (Appendix 1 and 2), with a spatial resolution of 50×50m pixels, and are suitable to urban climate-related studies, particularly at the metropolitan

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and city scales of analysis. The data here provided is related to the article entitled «Local Climate Zones in five Southern European cities: an improved GIS-based classification method based on free data from the Copernicus Land Monitoring Service» [1], and the corresponding method/ArcGIS based custom Toolbox is freely available in «Local Climate Zones classification from Copernicus Land Monitoring Service datasets: an ArcGIS-based Toolbox» [2].

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Specifications Table

Subject	<i>Environmental Science</i>
Specific subject area	<i>Urban Climatology</i>
Type of data	<i>Geospatial data: Local Climate Zones maps of Athen, Barcelona, Lisbon, Marseille and Naples</i>
How data were acquired	<i>Secondary/Processed data.</i>
Data format	<i>Geospatial analysis with a geographic information system (GIS)</i> <i>GeoTIFF raster grids at 50×50 m pixel resolution (.tif)</i> <i>Symbology ArcGIS Layers (.lyr)</i> <i>JPEG image versions.</i>
Parameters for data collection	<i>Secondary/Processed data.</i>
Description of data collection	Primary data described in the Data source location topic The maps depict the Local Climate Zone (LCZ) classification scheme in Athens (Greece), Barcelona (Spain), Lisbon (Portugal), Marseille (France) and Naples (Italy). A GIS analysis was used to reclassify land use/land cover primary datasets (see Data source location list) into the LCZ classes. Those primary datasets were collected from the Copernicus Land Monitoring Service website (https://land.copernicus.eu/) in June 2018, covering the five urban areas.
Data source location	Primary data sources: European Environment Agency (EEA), Urban Atlas 2012, (2016). https://land.copernicus.eu/local/urban-atlas/urban-atlas-2012 . European Environment Agency (EEA), Building Height 2012, (2018). https://land.copernicus.eu/local/urban-atlas/building-height-2012 . European Environment Agency (EEA), Corine Land Cover 2012, https://www.eea.europa.eu/Data-and-Maps/Data/External/Corine-Land-Cover-2012 . (2016). European Environment Agency (EEA), Imperviousness Density, (2018). https://land.copernicus.eu/pan-european/high-resolution-layers/imperviousness/status-maps/2015 . European Environment Agency (EEA), Tree Cover Density, (2018). https://land.copernicus.eu/pan-european/high-resolution-layers/forests/tree-cover-density . European Environment Agency (EEA), Dominant Leaf Type, (2018). https://land.copernicus.eu/pan-european/high-resolution-layers/forests/dominant-leaf-type . European Environment Agency (EEA), Grassland 2015, (2018). https://land.copernicus.eu/pan-european/high-resolution-layers/grassland/status-maps/2015 . OpenStreetMap contributors, Planet dump [Data file from June 2018], (2015).
Data accessibility	With the article
Related research article	Ana Oliveira, Samuel Niza, António Lopes, Local Climate Zones in five Southern European cities: an improved GIS-based classification method based on free data from the Copernicus Land Monitoring Service, Urban Climate. In Press.

Value of the Data

- The Local Climate Zones (LCZ) scheme has been acknowledged as a standard classification method in climate-related research, and these LCZ datasets assure improved accuracy and spatial detail.

- The maps allow climate-researchers to explore these cities' typical LCZ class climate-related performance, as well as benchmarking results across European cities.
- They can also be useful as inputs to climate numerical modelling, particularly at the mesoscale.
- These LCZ datasets were produced with an alternative geographic-information-systems (GIS)-based method, based on freely accessible Copernicus Land Monitoring Service (CLMS) data, assuring an easy process to replicate the method to all European cities that have Urban Atlas information available (785 Functional Urban Areas (FUA) in EEA39 countries).

1. Data description

The LCZ scheme is an international standard classification[3,4] extensively used by the urban-climate research community. Fourteen geospatial datasets in both *ArcGIS .lyr* (Appendix 1) and raster *GeoTIFF* (Appendix 2) formats are presented here, depicting Local Climate Zones (LCZ) classification in Athens, Barcelona, Lisbon, Marseille and Naples [3,4]. The datasets presented here correspond to four alternative LCZ versions for the cities of Athens and Lisbon, and two alternative versions for the cities of Barcelona, Marseille and Naples. The contents of each map, are described as follows:

- Datasets with a name ending in `_LCZ_v1` [i.e. `AT_LCZv1`, `BCN_LCZv1`, `LX_LCZv1`, `MRS_LCZv1` and `NPL_LCZv1`]: depict urban LCZ classes, with residential areas classified by built-up density, without building height designation (i.e. LCZ classes 1, 2 and 3 grouped as LCZ 123, and LCZ classes 4, 5 and 6 grouped as LCZX 456); tree cover classes are not reclassified according to leaf type;
- Datasets with a name ending in `_LCZv1_leaf` [i.e. `AT_LCZv1_leaf`, `BCN_LCZv1_leaf`, `LX_LCZv1_leaf`, `MRS_LCZv1_leaf` and `NPL_LCZv1_leaf`]: depict urban LCZ classes, with residential areas classified by built-up density, without building height designation (i.e. LCZ classes 1, 2 and 3 grouped as LCZ 123, and LCZ classes 4, 5 and 6 grouped as LCZX 456); tree cover classes are classified according to the dominant leaf type (DLT), (LCZ classes A and B reclassified into A/B deciduous and A/B coniferous);
- Datasets with a name ending in `_LCZv1_BH` [i.e. `AT_LCZv1_BH` and `LX_LCZv1_BH`]: depict urban LCZ classes, including residential areas classified according to mean building height; tree cover classes are not reclassified according to leaf type; these are the datasets that correspond to the standard LCZ classes, although some neighbourhoods are also grouped as "mixed rise" due to building height unavailability;
- Datasets with a name ending in `_LCZv1_BH_leaf` [i.e. `AT_LCZv1_BH_leaf` and `LX_LCZv1_BH_leaf`]: depict urban LCZ classes, including residential areas classified according to mean building height; tree cover classes are classified according to the dominant leaf type (DLT), (LCZ classes A and B reclassified into A/B deciduous and A/B coniferous);

Each *ArcGIS .lyr* file is accompanied by a corresponding Attribute Table that includes the following classification fields: Value (numerical field corresponding to an LCZ code), Count (number of pixels per class), LCZ (string LCZ class acronym), Descript (string LCZ description) and Area (total LCZ class area, in m²). Table 1 lists all the datasets as well as the classes they contain. Further details are available in appendix A from the original research article [1]. A set of *jpeg* files is also available in the original research paper [1], for easier visualization. Their names and content are those of the corresponding dataset.

2. Experimental design, materials and methods

2.1. Input data

The LCZ maps result from a GIS-based reclassification process that uses several input geospatial layers from the CLMS, as listed in Table 1 of the original research article [1]. The Urban Atlas

Table 1
List of LCZ map datasets and corresponding classes contained in the attribute tables of the 5 cities: Athens (AT), Barcelona (BCN), Lisbon (LX), Marseille (MRS) and Naples (NPL).

Local Climate Zones Included		Built-up Density (LCZ 1–10, grouped by density only)	Building Height (LCZ 1–10, grouped by density and built-up height)	Dominant Leaf Type (LCZ A and B, with coniferous and deciduous sub-classes)
Raster grid dataset (*.tif) / corresponding Arcmap symbology layer (*.lyr)				
AT_LCZv1.tif / AT_LCZv1.lyr		yes	no	no
AT_LCZv1_leaf.tif / AT_LCZv1_leaf.lyr		yes	no	yes
AT_LCZv1_BH.tif / AT_LCZv1_BH.lyr		no	yes	no
AT_LCZv1_leaf_BH.tif / AT_LCZv1_leaf_BH.lyr		no	yes	yes
BCN_LCZv1.tif / BCN_LCZv1.lyr		yes	no	no
BCN_LCZv1_leaf.tif / BCN_LCZv1_leaf.lyr		yes	no	yes
LX_LCZv1.tif / LX_LCZv1.lyr		yes	no	no
LX_LCZv1_leaf.tif / LX_LCZv1_leaf.lyr		yes	no	yes
LX_LCZv1_BH.tif / LX_LCZv1_BH.lyr		no	yes	no
LX_LCZv1_leaf_BH.tif / LX_LCZv1_leaf_BH.lyr		no	yes	yes
MRS_LCZv1.tif / MRS_LCZv1.lyr		yes	no	no
MRS_LCZv1_leaf.tif / MRS_LCZv1_leaf.lyr		yes	no	yes
NPL_LCZv1.tif / NPL_LCZv1.lyr		yes	no	no
NPL_LCZv1_leaf.tif / NPL_LCZv1_leaf.lyr		yes	no	yes

(UA) [5] and Corine Land Cover (CLC) [7] shapefiles of the 5 cities were used as the main baseline features for the reclassification, including each study area delimitation (versions 2012, in 10 m spatial resolution and shapefile format). Further Pan-European raster layers were also considered to determine non-urban land cover LCZ classes, namely Imperviousness Density (IMD) [8], Tree Cover Density (TCD) [9], Dominant Leaf Type (DLT) [10], Grassland (GRA) [11], all in GeoTIFF raster format, 20×20m spatial resolution and 2015 versions. The Urban Atlas Building height [6] information was used to distinguish residential areas accordingly. OpenStreetMap (OSM) layers were used to identify heavy industry facilities [12].

2.2. GIS-based classification model

The GIS-based methodology uses a combination of the UA and CLC vector datasets as the LCZ baseline feature class, preserving the shapefile format throughout the process. Most built-up LCZ classes (LCZ's 1–10) were reclassified directly from the UA classes, by comparing both classifications' specifications in terms of density, imperviousness and typical land use/cover. Additional land use information from OSM was used to distinguish LCZ's 8 and 10. An illustration of the classification flows is available in Figure 1 of the original research article [1]. The methodology was implemented in ArcGIS software, using the Model Builder functionalities to develop a custom tool. The detailed reclassification algorithm documentation, as well as the resulting ArcGIS Toolbox, are both freely available in [2].

2.3. Accuracy assessment

The LCZ maps converted from the shapefile to a 50 m pixel raster format, were subject to the accuracy assessment, by randomly selecting 25 validation sample pixels per LCZ class. In each sample location, the dominant LCZ class within a 25 m radius was identified (according to satellite true colour imagery and 3D information from Google Earth) and compared with the GIS-based classification output. The sample classifications, arranged as confusion matrices, have determined an average overall accuracy of 81% and a 0.79 kappa coefficient. Individual classes

were also assessed, as results indicate that the UA-based method proves great accuracy in urban areas, as LCZ's 1–10 showed, on average, 90% agreement. Lower density settlements (LCZ's 456 and 9) had the lowest accuracies, but still above the 80% - this agrees with the difficulty in characterizing suburban typologies, which are more disperse and less homogenous, a problem already present in the UA input data. Vegetation classification proved to be less accurate, particularly the LCZ classes that represent lower and/or scattered typologies, with 50% misclassifications of LCZ D. Nonetheless, the issue was not overvalued due to their less permanent status. On the other hand, more permanent natural land cover typologies such as dense trees, water or bare soil land covers were correctly classified on more than 90% cases.

User's accuracy ranged from 88% to 96% on every class, except scattered-low vegetation LCZ's B-D. Thus, the method was considered reliable and useful.

Ethics Statement

The authors declare that the work did not involve the use of human subjects nor animal experiments.

Declaration of Competing Interest

The authors declare that they have no known competing for financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

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Map data copyrighted OpenStreetMap contributors and available from <https://www.openstreetmap.org>.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.dib.2020.105802](https://doi.org/10.1016/j.dib.2020.105802).

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